

# ***AIRBORNE RADAR***

**1944 / 1945  
HEAVY CONVERSION UNITS  
1661 & 1668**

**RAF WINTHORPE**

**RAF BOTTESFORD**

**5 GROUP BOMBER COMMAND**

**Produced by F/O James Sands RCAF  
Smiths Falls, Ontario, Canada  
February 2011**

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**Station Radar Officer at RAF Winthorpe and RAF Bottesford**  
**5 Group Bomber Command**

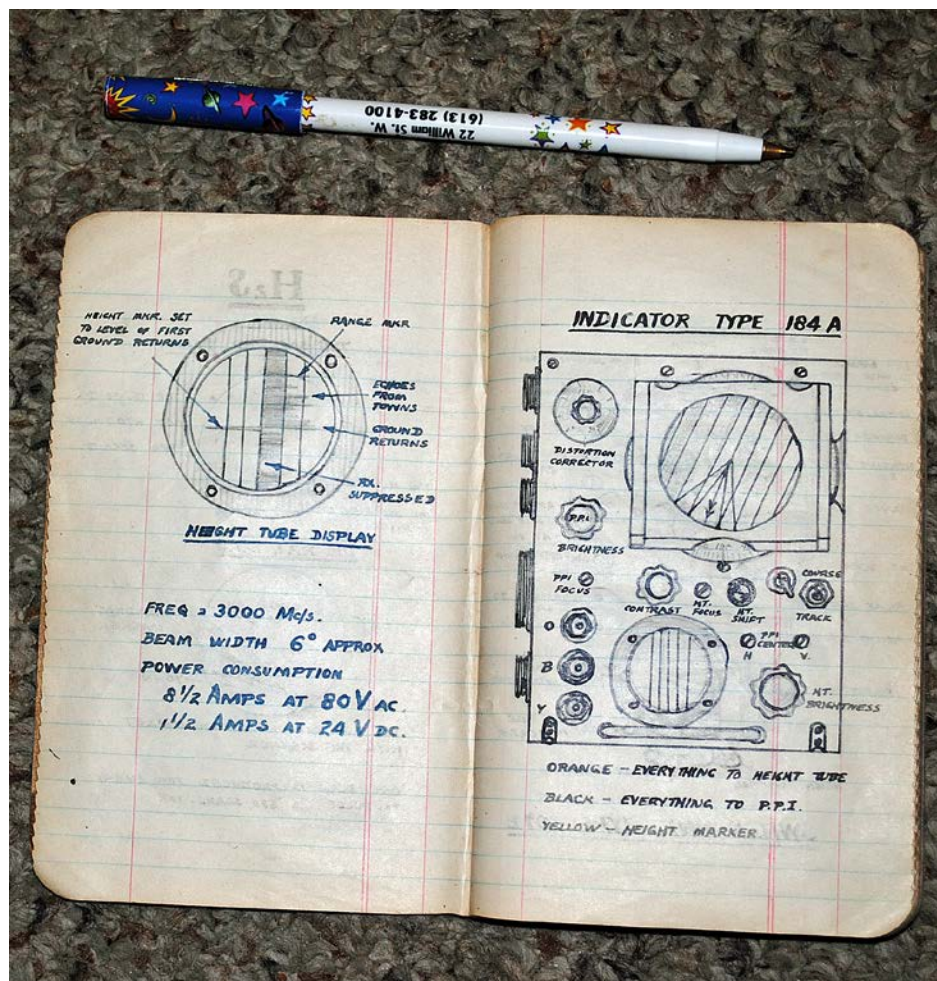


**Beaufighter at  
RAF  
Bottesford**

**Lancaster and  
Stirling  
bombers are  
shown below**



The following drawings and notes are taken from a small notebook kept by F/O James Sands RCAF while attached to the RAF as Station Radar Officer at RAF Winthorpe and RAF Bottesford 5 Group Bomber Command.



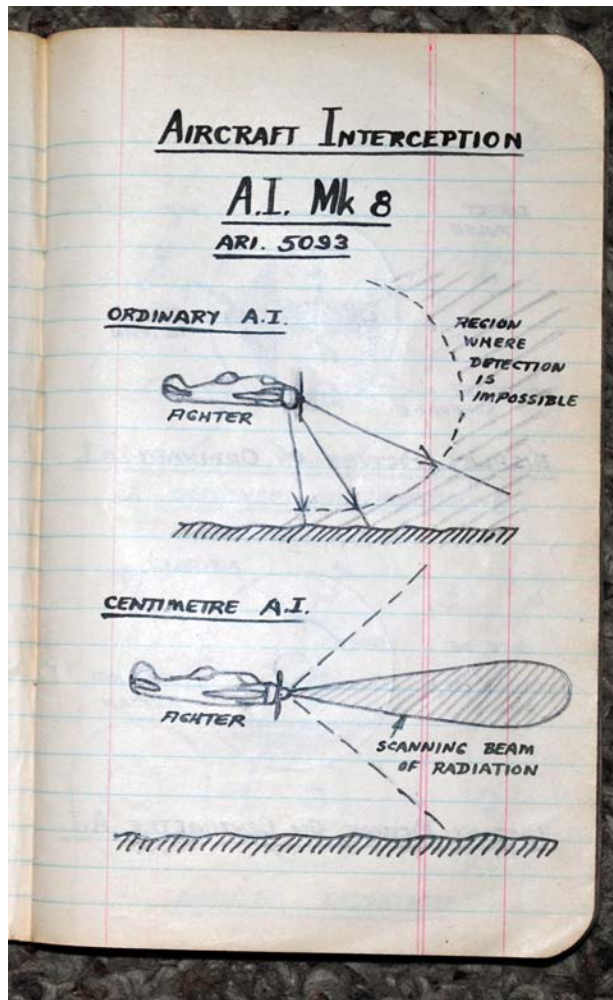
The drawings show what the equipment looked like and also drawings of what the aircrews saw on the various screens of the display units.

### THE FOLLOWING TYPES OF RADAR ARE COVERED

- Airborne Night Fighter gear
  - GEE navigation gear
- British H2S navigation & Bombing gear
  - Fishpond
- American early LORAN



## COMPARISON OF EARLY AIRCRAFT INTERCEPTION RADAR WITH LATER MICROWAVE EQUIPMENT

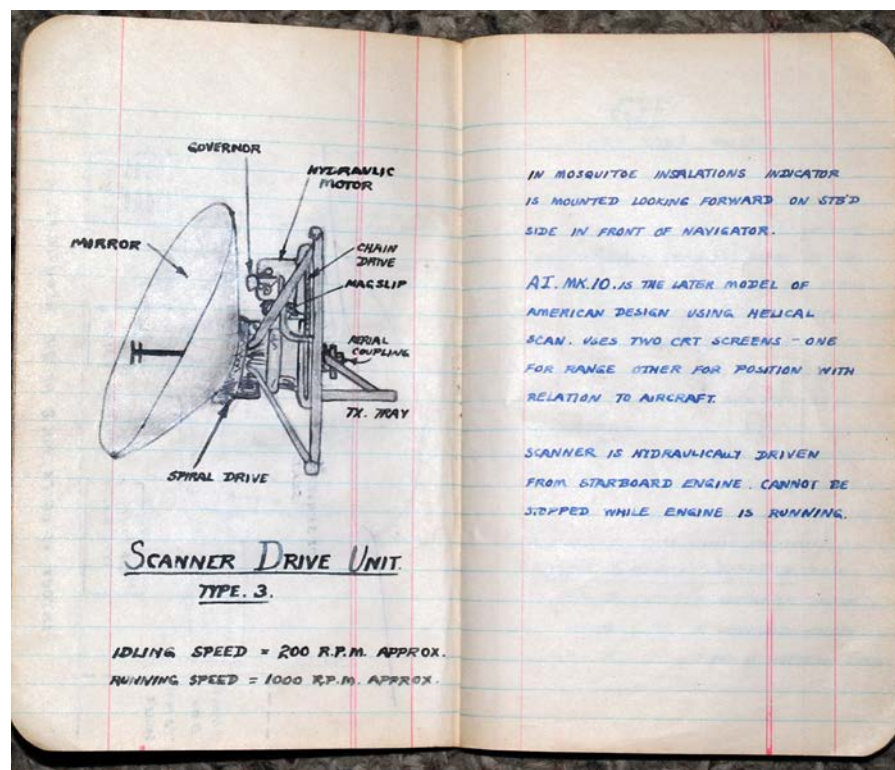
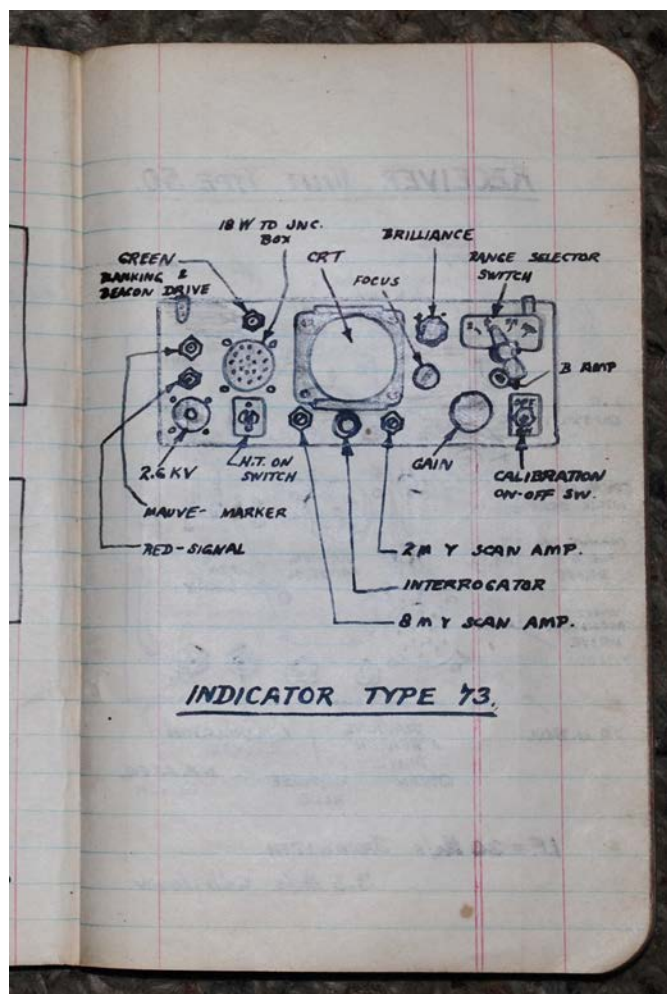


The early Radar units installed in the night fighters had a very wide coverage in front of the fighter and as a result there was a ground return signal that limited the range in front of the aircraft (shown in the upper sketch on the drawing at left).

When the Magnetron tube was developed it was then possible to have a Dish Antenna that had a narrow beam that could be swept in a spiral pattern to cover a large area in front of the fighter without a ground return. The lower drawing shows the difference in coverage.

The GCI (Ground Control Interception station) covered a given portion of the sky and would plot the enemy position and guide the night fighter to within about 4 miles of the target. At that time they would say to the fighter, **Flash your weapon.** The Radar operator in the aircraft would turn on his equipment and if he saw the

target he would say, **My weapon is flashed.** From then on the ground station would have no further contact with the aircraft. If however his equipment did not work, he would say, **My weapon is bent.** At that time the GCI would direct another fighter to the target. There were GCI stations all over England, each one having its own part of the sky to cover.

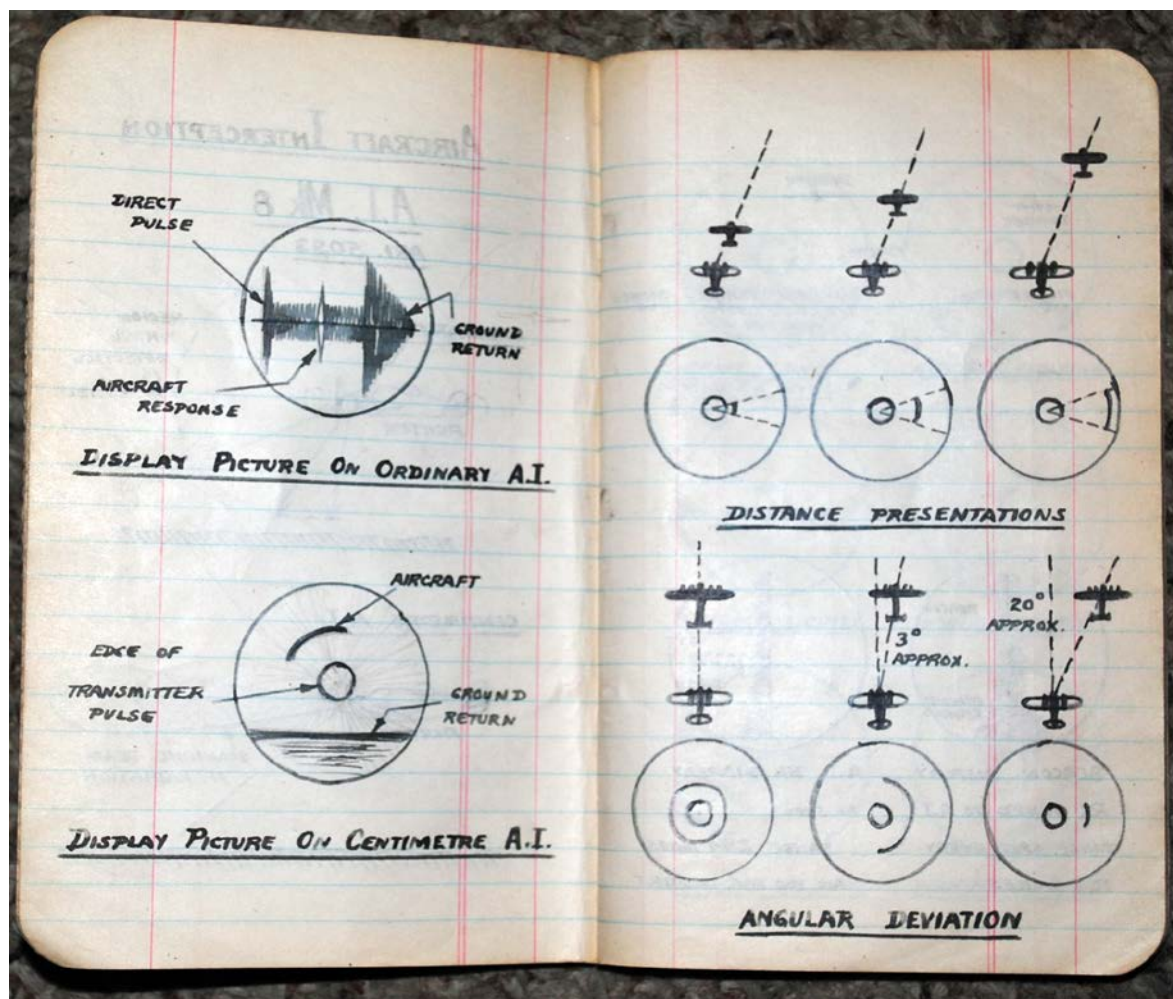


The Radar indicator shown at left is what the operator saw to find the enemy target. The drawing above shows the dish scanner. The dish was moved by a hydraulic motor energized by the starboard engine of the aircraft.

The dish assembly was installed in the nose of the aircraft inside of a bulbous enclosure that was well recognized on the Beaufighter aircraft. This equipment was used also in the famous Mosquito aircraft.

The scanner was driven in a spiral cone pattern from the center line to the outer edge of a cone. As a result the sky in front of the aircraft was covered by the continuous action of the scanner.



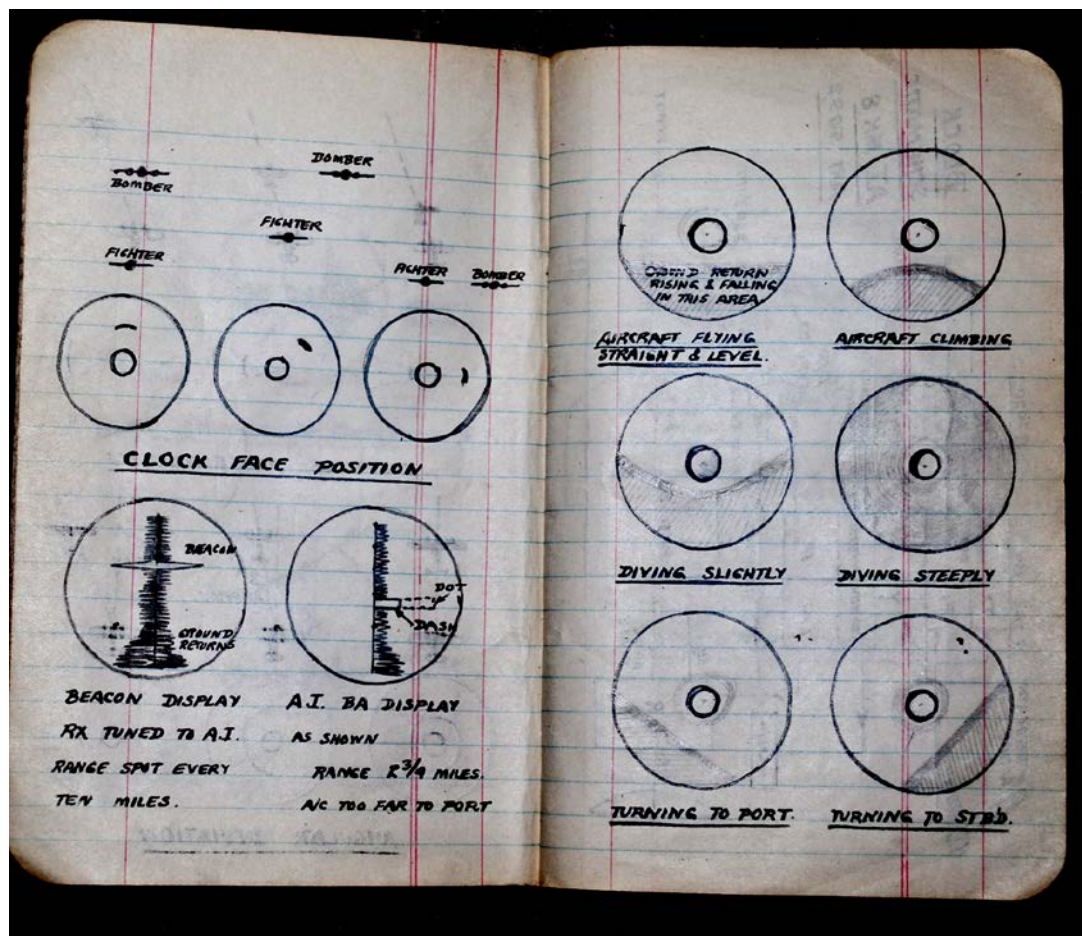


The left page shows what the radar operator saw on the screen of the earlier indicator as compared to the entirely different image the later micro-wave units displayed.

The right hand page illustrates what the operator saw on the screen of the radar indicator and the positions of where the enemy aircraft would be with reference to the different screen representations.

The operator would direct the pilot where to look for the target. When the target is dead ahead of the

fighter the display shows a complete circle and also the distance from the target. By this time the pilot would often see the flames from the enemy engine exhaust and would open fire with the 20 MM cannons after aligning the target in his gun sight. Many pilots found it to be an advantage if the target was slightly above the dead ahead position. This would be about 3 degrees. The operator would try to get this position on the screen.



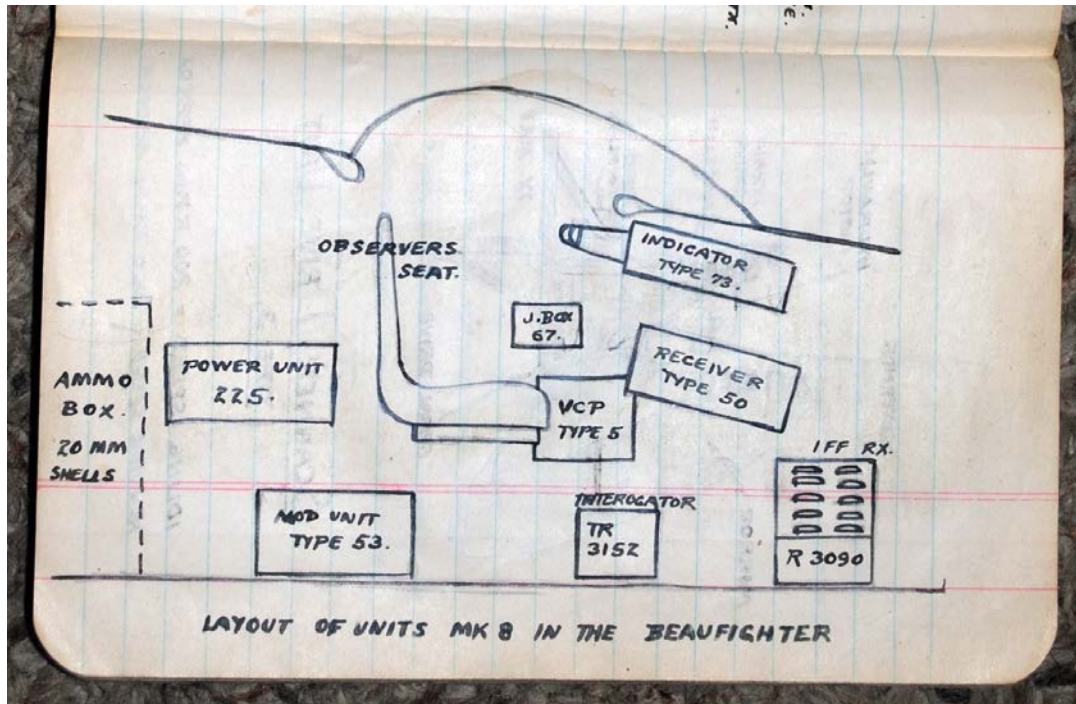
Every allied aircraft carried a unit called IFF. This unit, when airborne, would receive radar pulses from ground and airborne radar units. The received pulse or blip, as it was called, would show a coded signal that indicated the aircraft was a friendly one. However if there was no IFF indication then you would be dealing with an enemy aircraft.

The on-board IFF would show a pulse indication of the code of the day. The enemy did not have the IFF and its signal did not show the pulse indications. As you can see the IFF was a very important piece of equipment.

Built into every IFF was a thermal unit that was triggered by a special switch that would destroy the IFF if the aircraft crashed. It could also be destroyed by two special buttons on the aircraft if, for example, the crew had to abandon the aircraft while in the air. When the built-in thermal device was triggered the entire circuitry was destroyed. The temperature was so high it even melted the glass radio tubes. This was necessary to keep the design out of the hands of the enemy.



## BEAUFIGHTER COCKPIT LAYOUT



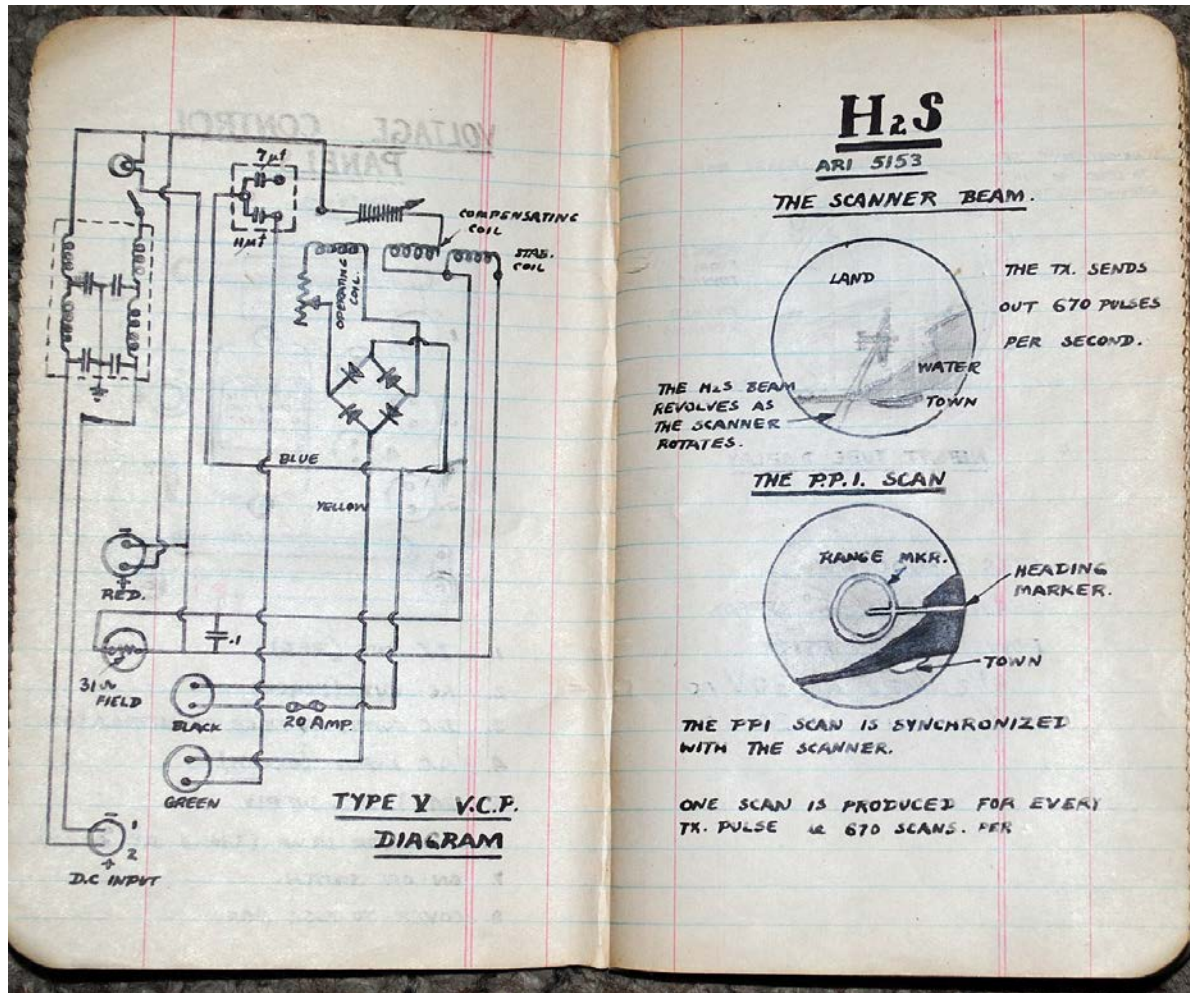
This sketch shows the layout of all the Radar gear installed in a Night Fighter. The operator faced the rear of the aircraft during an interception.

As you can see the operator is surrounded by a lot of equipment and it was quite cramped. If it was found necessary to abandon the aircraft he would get out through the top blister or a hatch in the floor under the seat. Either way was not easy because of all the gear and the parachute clipped on his chest.

Earlier I mentioned about the important IFF unit. The unit placement can be seen at the lower right of the drawing.

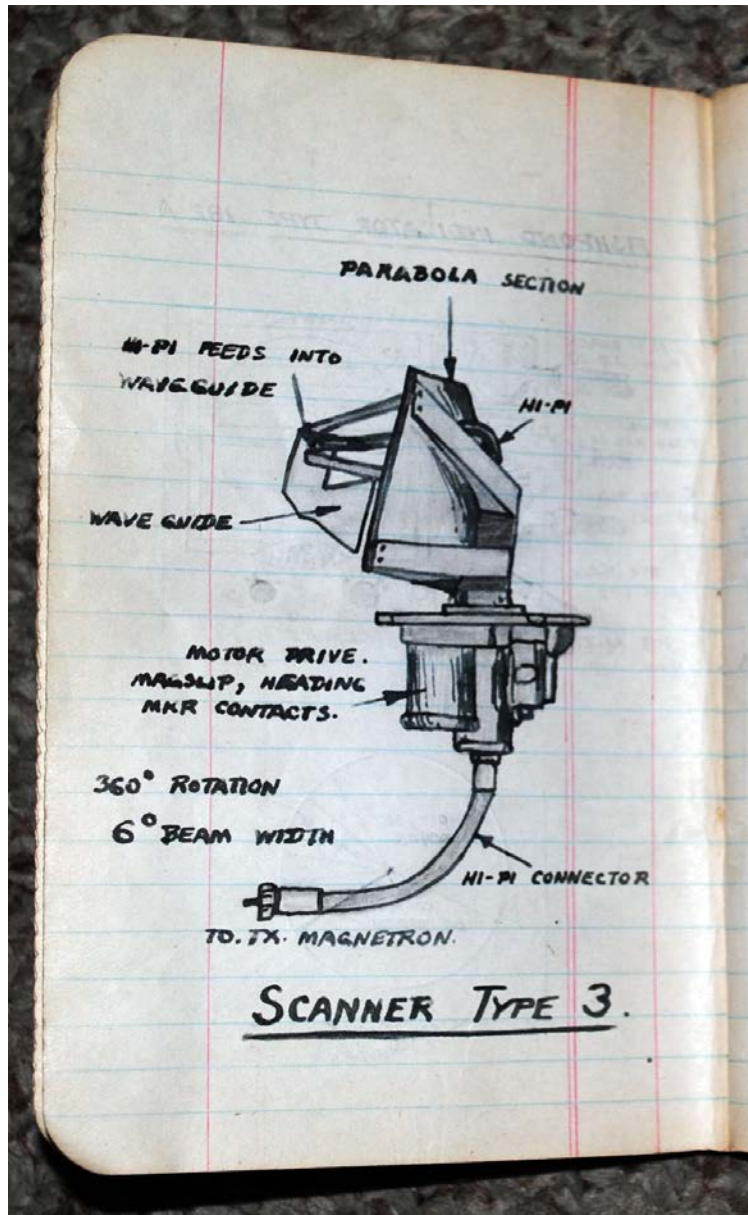


## H2S BLIND BOMBING & NAVIGATION GEAR



Bomber command aircraft were equipped with H2S. In the top sketch of the right hand page I show roughly what the eye would see of the terrain. The lower sketch shows what the navigator would see on the H2S screen.

## H2S SCANNER



The Scanner shown should have been drawn in the upside down view. The scanner hung down inside of a large blister under the belly of the aircraft.

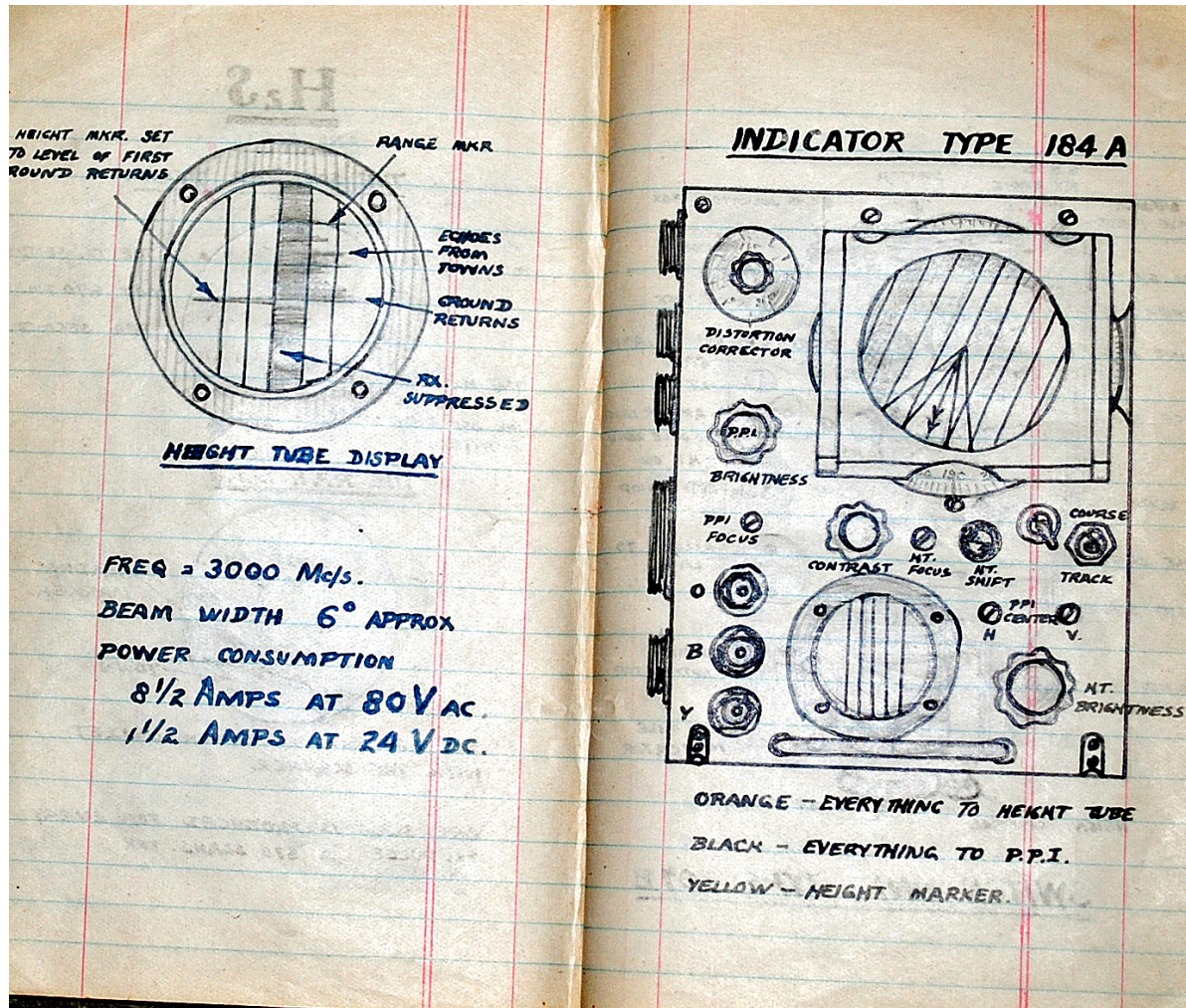
As the scanner rotated it had a narrow beam that would reflect off various ground features such as shorelines, built up areas, land masses etc. in the target area.

The microwave signals were fed to the scanner dish by a wave guide. The signal would be formed by the dish into a 6 degree wide beam. The scanner was rotated for the full 360 degrees and was synchronized with the trace on the H2S indicator.

The Radar mechanics soon found out that they could warm their hands on a cold day by holding them in front of the wave guide and the RF energy would warm them. We did not realize it at the time but it worked like our modern day microwave ovens.



## H2S INDICATOR

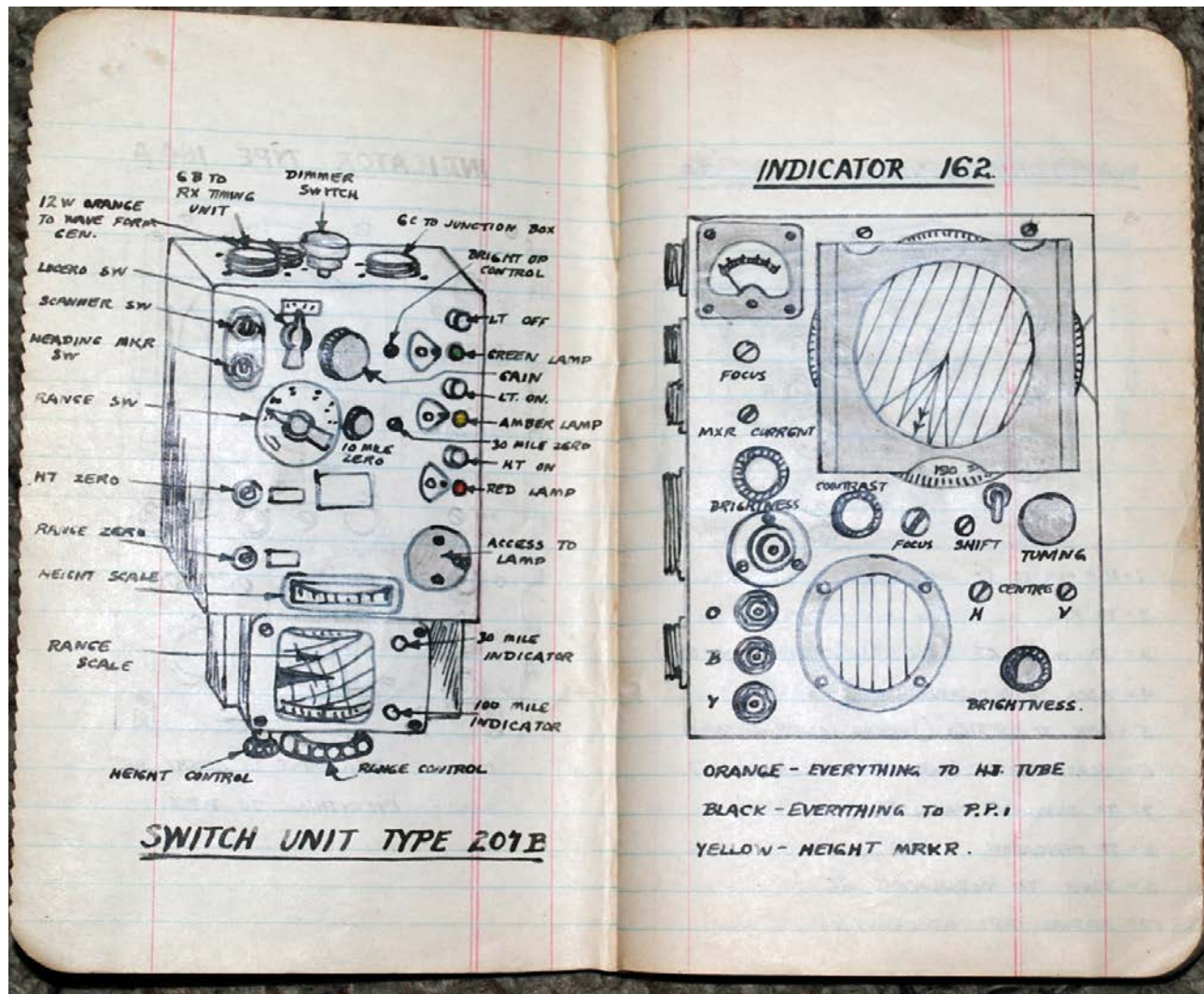


The height tube shown on the left page provides a visual adjustment display to set the altitude marker at the ground return blip.

This sets the actual height setting for the switching unit shown on the next page. The aircraft altitude must be set accurately for the run into the target.



## SWITCHING UNIT



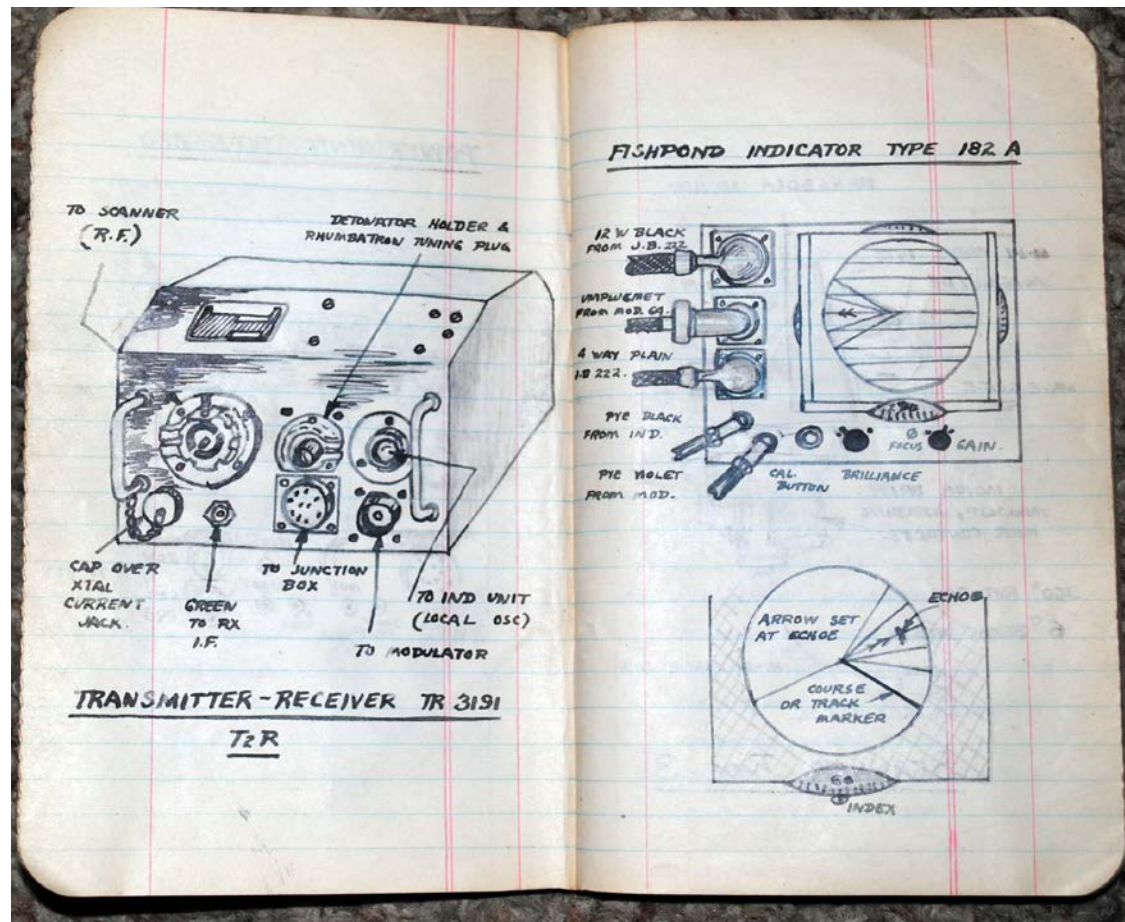
The switching unit is shown on the left hand page.

Under normal circumstances the bomb aimer would use his visual bomb sight on the run in to the target area.

However, if a blind run was necessary due to cloud cover over the target, then a Radar run would be necessary. The switching unit would provide the setting up information to enable a blind run. The navigator and the

bomb aimer would work together on the run.

# FISHPOND



The Fishpond indicator was set up at the wireless operators position. The purpose for Fishpond was to allow radar coverage immediately under the aircraft during flight looking for enemy aircraft, especially night fighters.

The gunners could not see under the bomber. The wireless operator would warn the crew and could give a location for the intruder. The pilot would then make the necessary change in flight pattern based on this information.



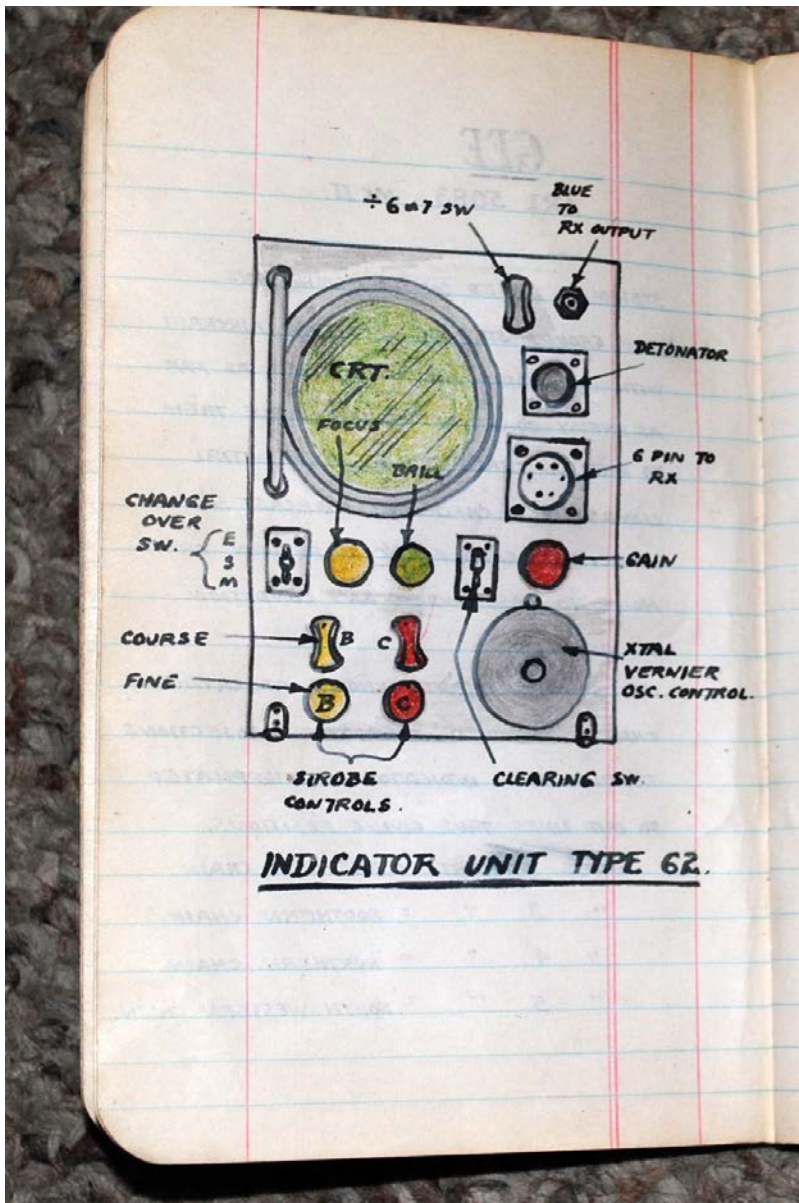
## GEE BOX NAVIGATION AID

The GEE navigation system was based on transmissions from strategically based ground stations.

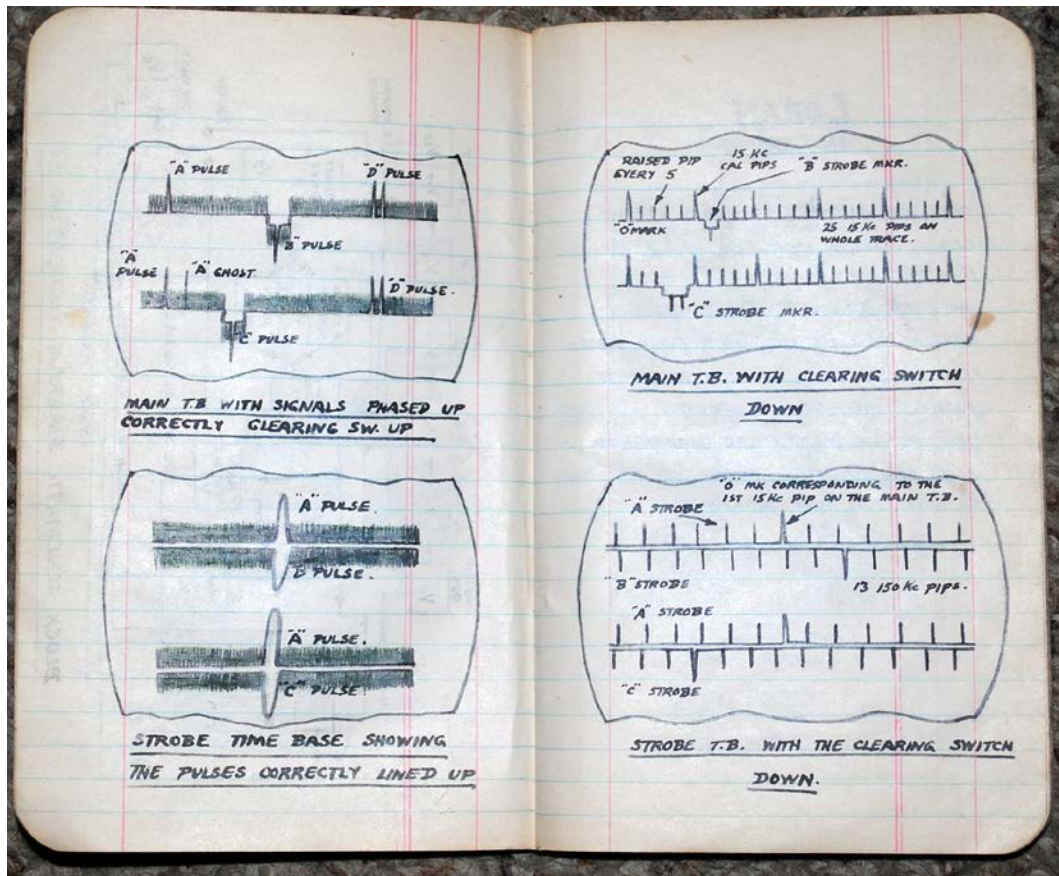
These stations provided the navigators with extremely accurate fixes. Due to the high frequencies used, the coverage was restricted to just over the horizon range. However, this allowed them to keep on track during the initial climb and to check the forecast wind velocities. It also enabled our aircraft to return to home base under any condition of visibility.

Special charts known as lattice charts drawn on mercator projections were used in this system.

The readings from GEE box were taken by the navigator and then applied to the chart in use for that target. The next page shows what the navigator would see on the screen of the Indicator shown in the sketch.



# CHARTS



- Series 2 –Eastern chain
- Series 3 –Southern chain
- Series 4 –Northern chain
- Series 5 –South Western chain

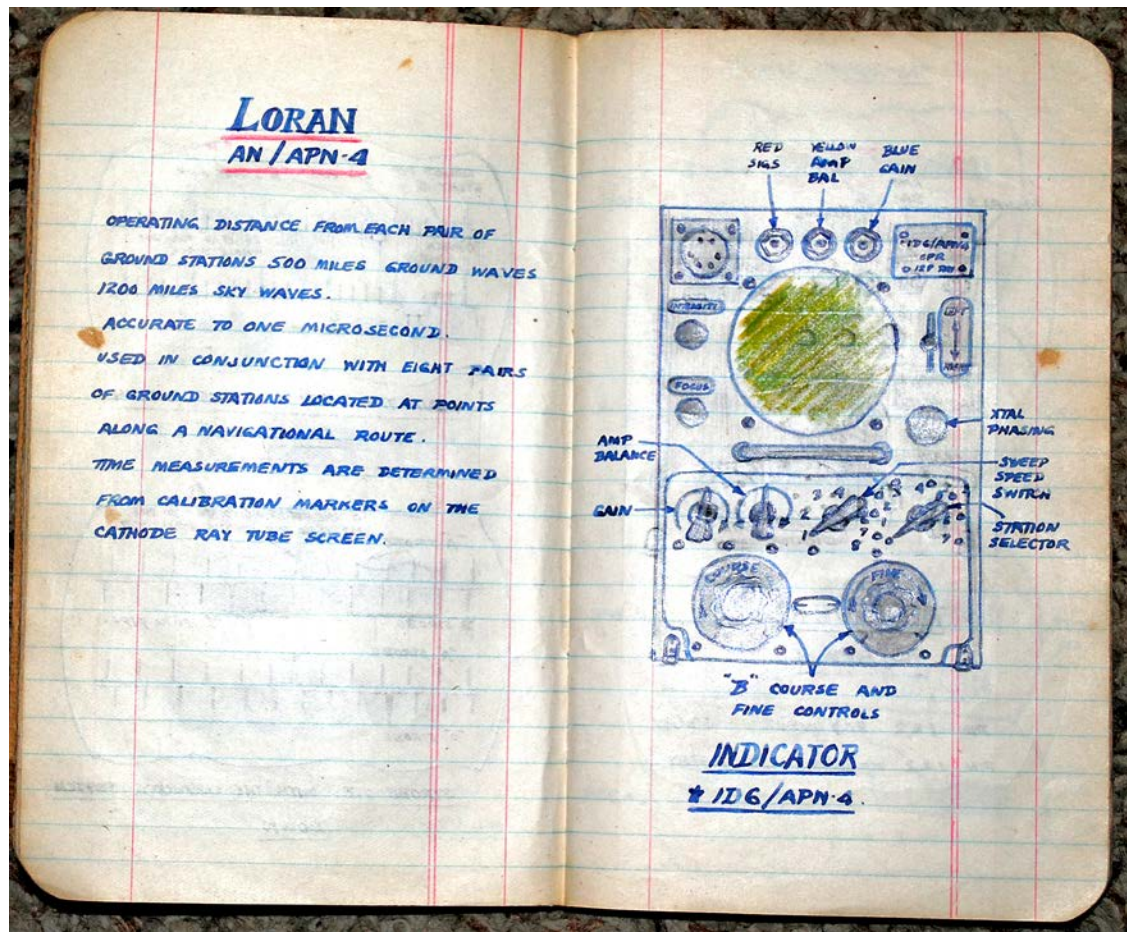
The charts listed above are for different parts of Britain and parts of the continent.

The navigator would see the signal pattern as shown in the sketch. Using the course knobs he would move the pedestals so that the blips would be as B pulse & C pulse. Then by using the fine adjustment knobs he would align the signals as shown at the lower left page. The final action is to push

the clearing switch and read where the signals are on the time bases. The upper one on the right is the large course reading and the lower right is the fine reading. These readings are then applied to the relative chart in use for your position when you took the reading. Navigators loved the GEE box especially coming home from a raid. Even with a solid cloud cover you could set up the coordinates for your home base and when the blips lined up as at shown above you were over your airfield.



## EARLY LORAN

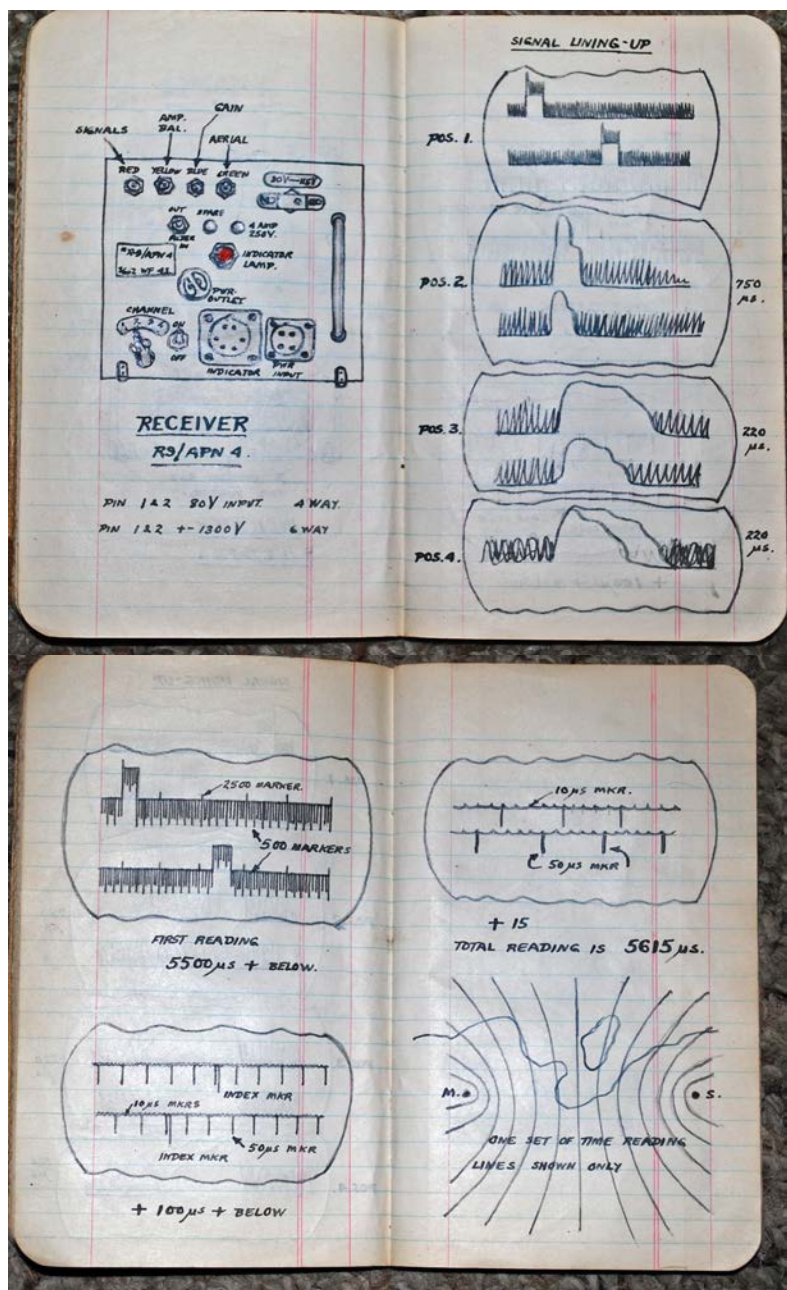


As mentioned earlier the GEE box had a limited range because of its high frequency. All the GEE ground stations were on British soil.

Loran was at 1.9 MHZ and was able to cover well into the enemy territory.

On Dec. 1943 I was getting ready to go to Burma by the south Atlantic route. As we were just about to leave Nassau a telegram was received canceling our flight and advising us that we were to go to England instead to put Loran into bomber command.

A special training section was installed at RAF Winthorp to train navigators and technicians on Loran. Operating distance from each ground station pair was now 500 nautical miles using ground wave charts and 1200 nautical miles using sky wave charts. Loran was not as convenient to use as the GEE box. The next page will show what the navigator would see on the Loran indicator screen.



As shown on the right hand page the blips on the screen are similar to the GEE box except that you would only see one pair of ground stations at a time. The GEE box screen would show two pairs at a time.

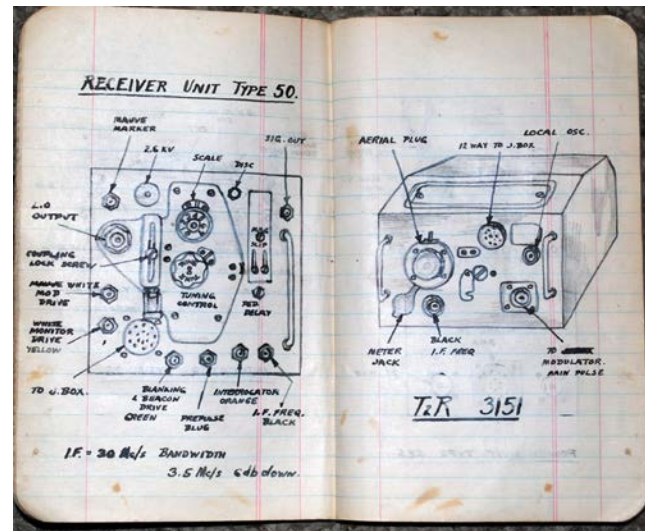
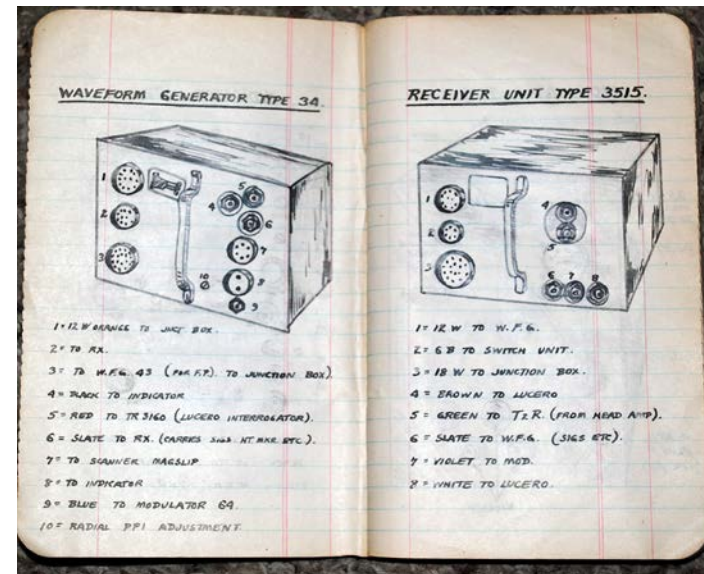
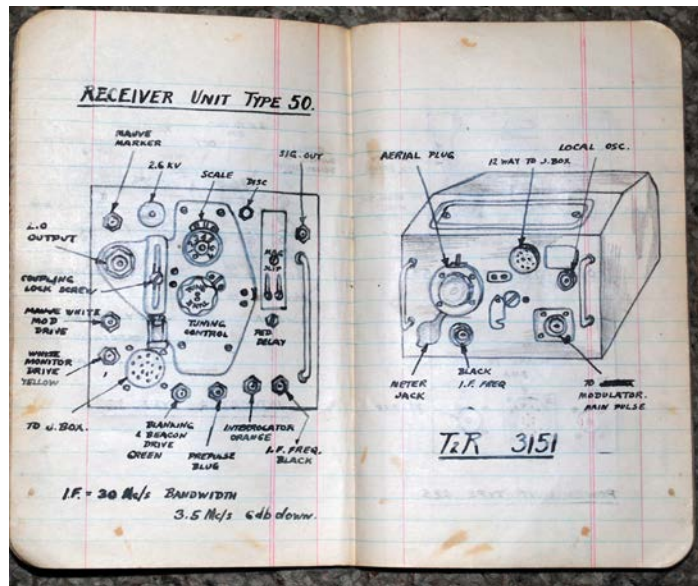
To take a fix you would move the pedestals to line up with the incoming signals. Positions 2-3-4 show finer adjustments required.

When everything is aligned you press the lock switch and read off the markers and apply the reading to the chart for you first line. Then you would carry out the same procedure on another station chain for a second reading to apply to the chart for the cross line. The chart above shows only one set of lines. I should have shown the cross lines as well.

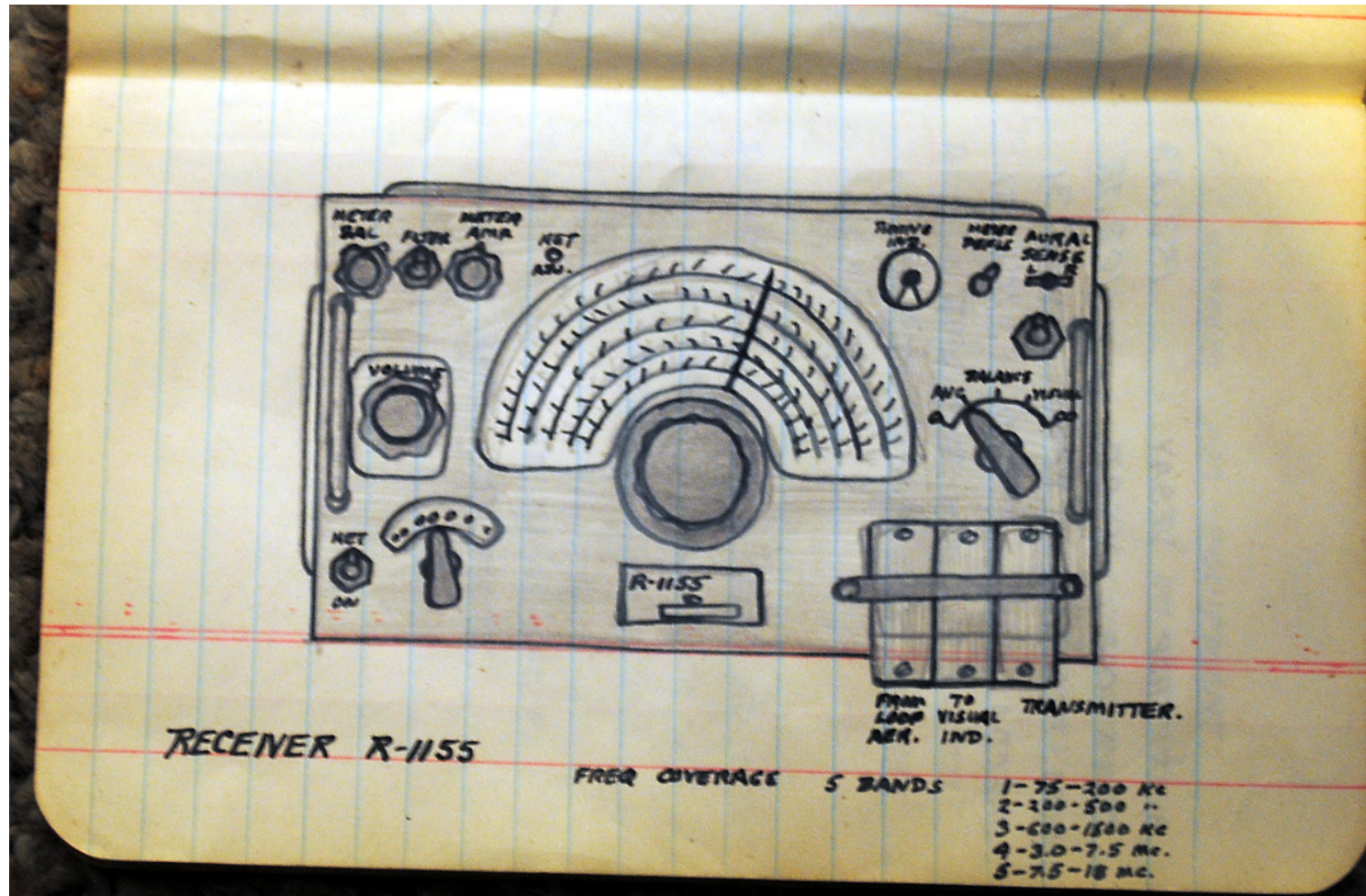
As you can see having to take a set of readings at two separate times was not as convenient as having both done at one time with the GEE box. However, it did allow for an extended range.



These sketches show some of the boxes that contained the necessary circuitry to supply the power distribution, pulse generators, time base signals, sweep circuits and all other electrical requirements.



## R-1155 RADIO RECEIVER



Wireless Operators will certainly recognize this receiver. It was the standard receiver used in most large aircraft in Bomber Command, Coastal Command, and many other branches of the Air Force.



The only known picture of a Stirling landing at Winthorpe

Stirling Bomber landing at RAF Winthorpe, Spring 1944

Photo by J. Sands, Radar Technical Officer

**The old Winthorpe airfield has now become the Newark Air Museum. They have made a DVD and some of the pictures are shown here.**



**Some of the radar mechs at RAF Winthorpe**



**Crew of 7 with their Stirling Bomber.**

A View Across the Airfield from a Lancaster Cockpit

